

2026

(Regular)

Physics (Core)

Paper Code : PY-CE-4234

Paper Name : Electricity & Magnetism

Time : 2 hours

Full Marks : 45

The figures in the margin indicate full marks for the questions.

1. Answer the following questions : 1×4=4
 - a) Write the dimension for electrical permittivity.
 - b) Show graphically how magnetic field varies with respect to distance from the centre of a circular current carrying conductor.
 - c) Define electric dipole moment.
 - d) Write the mathematical expression of the Biot-Savart Law.
2. Answer the following questions : 2×3=6
 - a) Derive Coulomb's law using Gauss's theorem in electrostatics.
 - b) Explain, how Lenz's law is in accordance with the conservation of energy.
 - c) Deduce Amperes' law in differential form.
3. Answer **any three** questions from the following : 5×3=15
 - a) Derive Poisson's equation. From this write Laplace's equation. Express both the equations in the Cartesian coordinate system.
2+1+2=6
 - b) Discuss impedance, reactance and admittance. What is the relationship between admittance and impedance ? 3+2=5

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- c) Find the divergence and curl of a magnetic field. $2\frac{1}{2}+2\frac{1}{2}=5$
- d) Define mean value and root mean square value of an alternating current. How they can be measured ? $2+3=5$
- e) Define self inductance. Deduce the expression for the self inductance. $1+4=5$
- f) Using Biot-Savart law, find the expression for magnetic field for a circular current carrying conductor. 5
4. Answer **any two** questions from the following : $10 \times 2 = 20$
- a) Deduce the expression for electric field at various distances from the center of a uniformly charged spherical shell using Gauss's law. Also show graphically the variation of the same with the distance. $8+2=10$
- b) Derive the expression for field and potential due to an electric dipole. $7+3=10$
- c) Compare between series and parallel resonant circuit.
A series LCR circuit with $L = 0.12 \text{ H}$, $C = 480 \mu\text{F}$ and $R = 23 \Omega$ are connected to a 230 volt variable frequency power supply,
- i) What is the source of frequency for which current is maximum? Obtain the maximum value of current.
- ii) What is the source frequency for which average power absorbed by the circuit is maximum ? Obtain the maximum value of absorbed power. $4+2+2+2=10$
- iii) What is the Q-value of the circuit ?
- d) Draw a neat labelled diagram of a moving coil ballistic galvanometer and derive the expression for charge, measured by the galvanometer. What is logarithmic damping ? $2+6+2=10$

